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CONTROL OF INSECTS THAT ATTACK DRY BEANS AND PEAS IN STORAGE [1]

By H. D. Nelson and C. K. Fisher

Five kinds of insects attack dry beans and peas in storage. They are the bean weevil, the cowpea weevil, the Indian-meal moth, the tobacco moth, and the almond moth. [2] The bean weevil and the cowpea weevil are the most destructive.

Losses caused by these insects, together with the cost of control measures, amount to many thousands of dollars each year. The weevils infest ripening beans and peas in the fields and continue breeding in the seeds in storage. The moths may be considered as strictly storage pests, since they have not been observed attacking the ripening beans and peas in the field.

The length of life of all these insects is affected by temperature and by the moisture content of the seeds. Under ideal conditions the life cycle may be completed within 25 to 30 days, but under unfavorable conditions several months may be required. Damage is greatest in areas where the climate is warm.

DESCRIPTION AND HABITS

Bean Weevil

Adults of the bean weevil are dusky in color and are 2/16 to 3/16 inch in length. They have well-developed wings and are capable of flying.

A female may deposit 150 or more eggs during her lifetime. The eggs, which are smooth and white resembling polished rice, are laid singly or in

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[1] Formerly issued as EC-27, "Control of Insects that Attack Dried Beans and Peas in Storage," December 1952; reissued, without change in text, by the Biological Sciences Branch, Marketing Research Division, Agricultural Marketing Service.

[2] The scientific names of the insects discussed are given on page 7.

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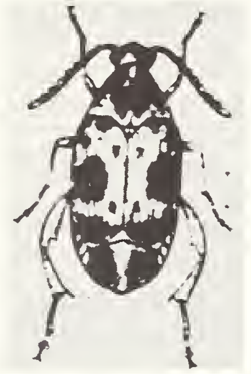
clusters among or near the beans. The eggs hatch into tiny white larvae, which eat their way into the beans. The entrance holes are small and easily overlooked.

In warm weather the larvae develop rapidly within the beans and soon reach the pupal, or resting, stage, from which the adults are formed. The adults then chew a round opening through the seed coat and emerge. Within a short time mating occurs and the female is ready to lay eggs.

The bean weevil is capable of developing in all varieties of common dried beans and cowpeas. Several weevils have been found within a single seed.



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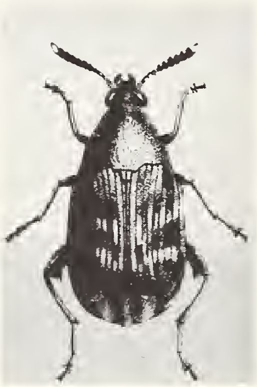
Cowpea weevil



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Bean weevil

Cowpea Weevil

Adults of the cowpea weevil are about the same size as those of the bean weevil, but they differ in color, activity, and manner of egg laying. The cowpea weevils are various shades of brown with four conspicuous black spots on their backs. They are extremely active and are strong fliers.

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Eggs of the cowpea weevil on blackeye cowpeas

The female attaches her eggs, which are nearly transparent when first laid, to the surface of the cowpeas. If the weather is warm, the eggs soon hatch and the larvae enter directly into the cowpeas. In chewing a tunnel into them, the larvae push some of the borings back into the empty eggshells, making them white and very easily seen. The life cycle is the same as that of the bean weevil.

The cowpea weevil is primarily a pest of dry cowpeas and is apparently not capable of developing successfully in the common varieties of beans. However, it will lay eggs on any of these varieties.

Moths

The three kinds of moths that attack dry beans and peas are similar in size, each having a wing spread of 7/8 inch. The female lays her eggs among or near the beans. Tiny caterpillars, or larvae, hatch from the eggs and soon start feeding on the stored beans. When full grown the caterpillars find their way to the outside of the pile or sack of beans and spin cocoons in some protected spot, in which to change to adult moths.

The damage caused by these insects results chiefly from the webbing and frass that is deposited among the beans while the larvae are feeding. Therefore, beans and peas that have thus been damaged must be cleaned and sacked before they can be sold. The larvae can only feed on beans and peas that are split or have cracked seed coats. They also attack such foods as cereals, nut meats, and dried fruits.

HOW BEANS AND PEAS BECOME INFESTED WITH WEEVILS

The bean weevil and the cowpea weevil attack beans and peas while they are in the field. In many areas they may become heavily infested before they are taken to the warehouse. The adult weevils live but a few weeks, just long enough to lay their quota of eggs. To accomplish their purpose they must have access to beans and peas as food. In areas where field infestations occur, it has been observed that small lots of infested beans and peas have been held on the farms, thus supplying weevils with a means of surviving throughout the year. Beans left in the seeder, left-over seed beans, unused bean screenings, and beans remaining in the straw offer ideal places for weevil development and survival.

During the winter months the weevils develop slowly within the beans. The following summer, when the new crop begins to ripen, weevils emerging from odd lots of beans on the farm are attracted to it. The females fly into the field and lay their eggs on the pods or on the beans within the pods. At that time of year the eggs soon hatch. If infestation occurs early in the ripening period, one generation may be completed before the beans or peas have been thrashed and taken to the warehouse.

Beans and peas that have not become infested in the field may become infested in storage in the same manner as on the farm. Odd lots of beans held in the warehouses or packaging plants may harbor weevils and contaminate uninfested materials.

CONTROL BY SANITATION

After the planting has been completed, the left-over seed should be properly cared for. It should either be used as feed or fumigated and stored in tight containers. Bean and pea straw and screenings should be fed to livestock, used as fertilizer, or burned. Beans to be kept for eating purposes should be fumigated or heated to 145° F. for 10 minutes and stored in tight containers. All other unused lots of beans should be similarly treated.

If such a program is to be effective, all bean and pea growers in an area must cooperate. One careless grower may provide enough weevils to infest his neighbors' beans.

Similar procedures should be followed by warehouse and packaging-plant managers. At the end of the bean season a thorough cleaning program should be undertaken by warehouse operators. All loose beans, odd lots of beans, and those remaining in the cleaning machinery should be gathered up and either fumigated or disposed of. All bean samples should be carefully examined and fumigated if necessary. Packaging-plant operators should practice similar methods.

CONTROL BY FUMIGATION

Fumigation will destroy insects that attack dry beans and peas in storage. The temperature, tightness of space, dosage, and exposure period must be carefully regulated. In areas where weevils are known to occur, all the beans and peas should be fumigated as soon as they reach the warehouse, and certainly before they are cleaned.

They can be fumigated in several ways, as described below. Choose the method that is most suitable for your conditions. With all methods the exposure period should be at least 24 hours.

Warehouse Fumigation

Whenever possible the entire warehouse should be fumigated. Warehouse fumigation should not be attempted, however, unless the building is tightly constructed or can be sealed without too much expense. Methyl bromide or chloropicrin may be used as a fumigant. It is desirable to circulate the gas-air mixture within the warehouse by means of fans, allowing them to operate for at least 30 minutes after the gas has been introduced.

Fumigation in Atmospheric Vaults

Good results may be obtained by fumigation in atmospheric vaults if they are tightly constructed and have close-fitting doors. However, considerable time and expense are required to load and unload the vaults. Methyl bromide and chloropicrin can be used as fumigants.

Fumigation under Gastight Tarpaulins

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A stack of beans being fumigated
under a gastight tarpaulin

This method of fumigation is especially popular in California, and satisfactory results may be obtained if sufficient care is exercised. Tarpaulins made from cotton or nylon material that has been coated with plastic or rubber and others made of plastic film may be used. The tarpaulin must be in good condition, and its edges should be held securely to the floor to prevent gas from escaping. Sand snakes 4 to 6 inches in diameter and 4 to 5 feet long may be used for that purpose. Before the tarpaulin is put in place, several bags of beans placed on end should be distributed over the top of the stack to create an air space beneath the tarpaulin for the diffusion of the gas.

Satisfactory results may be obtained with methyl bromide. This fumigant should be introduced into the air space near the top center of the stack. Another satisfactory fumigant is a mixture of ethylene dibromide (5-15 percent) and carbon tetrachloride (85-95 percent). Since it is a liquid, it can be sprayed or sprinkled over the top of the pile. It may also be used in an atmospheric vault. Carbon disulfide has been used successfully, but it is not recommended because of the fire hazard.

Freight-Car Fumigation

If beans and peas are to be fumigated in freight or refrigerator cars, great care should be used in the selection of the cars. The tightness of railway cars varies considerably. All cars should be sealed around the doors and other openings, properly marked, and not moved during the exposure period. Methyl bromide or chloropicrin may be used as the fumigant.

FUMIGATION DOSAGE SCHEDULE

Type of fumigation	Fumigant	Pounds per 1,000 cubic feet	Temperature (° F.)
Warehouse	Methyl bromide or chloropicrin	2	Above 60
	Methyl bromide	3	Below 60
Atmospheric vault	Methyl bromide	1½	Above 60
		3	Below 60
	Chloropicrin	1½	60 or above
Gastight tarpaulin	Methyl bromide	2	60 or above
		3	Below 60
	Ethylene dibromide plus carbon tetrachloride	3 (gallons)	
Freight car	Methyl bromide	3	60 or above
		4	Below 60
	Chloropicrin	3	Above 70

CAUTION

The chemicals used in fumigating beans and peas are poisonous to human beings and warm-blooded animals. They should be handled with great care. Warehouse, vault, and tarpaulin fumigation should be done by experienced fumigators, who are familar with the hazards. Workers exposed to the gases should wear gas masks equipped with canisters approved for the particular gas. It should be remembered that canisters have a limited life and must be changed frequently. Furthermore, they do not give protection against concentrations higher than 2 percent.

SCIENTIFIC NAMES OF INSECTS DISCUSSED

Bean weevil	*Acanthoscelides obtectus* (Say)
Cowpea weevil	*Callosobruchus maculatus* (F.)
Indian-meal moth	*Plodia interpunctella* (Hbn.)
Tobacco moth	*Ephestia elutella* (Hbn.)
Almond moth	*Ephestia cautella* (Wlk.)

PREVIOUS ISSUES OF THIS SERIES RELATED TO STORED-PRODUCT INSECTS

AMS-4. Fumigation of dry beans and cowpeas on the packaging line. January 1955.

AMS-5. Procedure for the fumigation of dry beans and cowpeas on the packaging line. January 1955.

AMS-49. Timing of sprays to control the cigarette beetle. May 1955.

AMS-58. An insect preventive program for peanut warehouses. June 1955.

AMS-64. Protecting stored seed from insect attack. (Revision of former Bureau of Entomology and Plant Quarantine publication E-677, issued December 1945.) July 1955.

AMS-73. Effect of varying the volatilization of methyl bromide by combinations with various solvents on its distribution in bulk grain fumigation. December 1955.

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